The Role of European Age-Group Championships in Senior Participation Rates

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ABSTRACT

The European Athletics U20 and U23 Championships are important steps in the career path of talented young athletes. Previous studies have examined how well the very best athletes from these age group championships perform in subsequent high-level competition, including the Olympic Games and IAAF World Championships in Athletics. But these events also play an important role in simply retaining talented young athletes through to the senior level, which is of interest to the wider athletics community. This study aimed to evaluate the impact of the two championships by means of a detailed analysis of the overall participation rates in the post-junior careers of talented athletes. It included examination of the differences between disciplines and nations. The results show that the two championships improve the chances that those who take part will continue competing as seniors, and that the U23 championships are particularly effective in maintaining participation between the ages of 25 and 29. The study concludes with a number of recommendations to Member Federations for supporting young athletes in their transition to the senior ranks.

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Introduction

European Athletics' 'Your Sport for Life' strategy is based on important values such as competition, excellence, personal development and physical fitness. One of the 'twin pillars' of this strategy relates to high-performance and incorporates support for talented athletes in the form of the performance pathway of youth (U18), junior (U20) and U23 age group championships[1]. Though many young athletes progress via these championships to compete at global level, and some even become Olympic and world champions[2], it is just as important to recognise the impact the events have on maintaining participation rates amongst high performing young athletes. The benefits of keeping these athletes in the sport are manifold, including better national competition standards, more positive role models in the sport, and important benefits for general health and well-being.

Two of the most important competitions in the European Athletics calendar are the track and field championships for U20 and U23 athletes. The European Athletics U20 Championships (previously known as the European

Athletics Junior Championships) and the European Athletics U23 Championships are biennial competitions held in uneven numbered years. The U20 championships have proven to be extremely important to young athletes, most of whom tailor their seasons so that their best performances are delivered at this event[3]. To be eligible for the U20 championships an athlete must be 19 years old or under, whereas to qualify for the U23 championships an athlete must be at least 20 years old and at most 22 years of age on December 31st of the year of competition[4].

The focus of this study was the important role played by the European Athletics U20 and U23 Championships in helping to keep young athletes involved in the sport of athletics as senior athletes, which is of interest to the wider athletics community including athletes, coaches, administrators and those involved in physical activity programmes. In this study, U20 athletes are referred to as juniors as many coaches and athletes will be more familiar with this term.

An understanding of the progression rates of youth and junior athletes to senior competition is well established[5-6], although research on the benefit of U23 competition is in its infancy[2]. Previous studies have predominantly examined how well the very best athletes have performed, e.g. from the point of view of those good enough to qualify for the Olympic Games or IAAF World Championships in Athletics. Research to date has not investigated the effect of competing in Area championships on participation rates amongst young athletes who are below this elite standard but who continue to compete in local and national events for their schools, clubs or universities.

The aim of this study was to evaluate the role of the European Athletics U20 and U23 Championships in maintaining the participation in athletes who had high performances at junior level. The objectives involved in achieving this aim were: to analyse the overall participation rates across the 10 years of each athlete post-junior competition; to analyse participation rates in the end five years of this period to examine specifically the value of the U23 championships; to compare different track and field events; and to compare results between different European Athletics Member Federations.

Methods

The performances of all European athletes born in the 10 years between 1978 and 1987 who appeared in the world junior outdoor ranking lists (obtained from www.tilastopaja.org) were analysed. The number of analysed competitors born in each of the 10 years is shown in Table 1 below. Athletes were included only if they had competed in an event that was held as part of the normal outdoor athletics programme (e.g. athletes who were ranked over 100m were included but not those ranked only over 60m). To maintain consistency between years, cut-off performances were applied based on the lowest performances included in the Junior Rankings in 2015 (as these represented the most conservative cut-off performances).

The world senior outdoor ranking lists (also obtained from www.tilastopaja.org) were then analysed for appearances by these junior athletes in the 10 years after they had become senior athletes (i.e. were too old for junior competition). For example, an athlete born in 1978 ceased to be a junior after 1997 and thus their appearances in the world rankings were analysed between 1998 and 2007. Athletes born in 1987 were analysed for the nine years between 2007 and 2015 as too few results were available for 2016 at the time of the study.

The results for each of the individual events (i.e. not including relays) held at the five editions of the European Athletics Junior Championships between 1999 and 2005 and the six editions of the European Athletics U23 Championships from 1999 to 2009 were obtained via the European Athletics website (www.european-athletics.org). Whether athletes who had appeared

Table 1: Details of athletes analysed per year of birth

Year of birth	No. of men	No. of women	Total no. of competitors
1978	320	207	**527**
1979	342	260	**602**
1980	367	311	**678**
1981	333	286	**619**
1982	280	306	**586**
1983	376	298	**674**
1984	362	330	**692**
1985	350	418	**768**
1986	397	427	**824**
1987	435	463	**898**
Total	**3562**	**3306**	**6868**

in the world junior outdoor rankings had also competed in any edition of these competitions was noted. Athletes were thus categorised as having competed in both championships, U23 only, Juniors only, or neither championship. Events over different distances in junior and senior competition were matched as appropriate (e.g. for race walking).

As many athletes appeared in the rankings for multiple events, only one event was kept for analysis to avoid duplicates. The single event chosen in these instances was based on whether the athlete had competed in that event at a European U23 or Junior championships, the number of subsequent appearances in the world rankings in each event, and if all these other things were equal, by which event their original junior ranking was higher. Nonetheless, athletes' performances in other events were included so that seasons spent on these events were counted in measuring the longevity of the athletes' careers. Special care was taken in cases where women changed their surnames, where athletes had transferred national allegiance, and where the status of federations had changed (e.g. Serbia / Montenegro). Attendance in either U23 or junior championship was not included if the athlete was recorded as Did Not Start (DNS) or was disqualified for doping offences (athletes were still included if they were disqualified for technical infringements such as in race walking).

The length of time athletes stayed in the sport for the 10 years after junior competition was measured in two ways. First, the number of years the athlete subsequently appeared in the world rankings was counted. For example, an athlete born in 1978 who appeared only in the world rankings in 1998, 1999 and 2000 scored 3. The range of possible scores for each athlete was therefore between 0 and 10. Second, the number of years the athlete appeared in the world rankings during the last five years of analysis was counted and expressed as a coefficient, e.g. an athlete appearing in the World Rankings twice in the last five years had a coefficient of 0.40. This was done to measure the effect of the U23 championships on athletes' participation into their late 20s. Results were averaged for each category of athlete (i.e. those who competed at both championships, U23 only, Juniors only, and neither), per event, as well as for each Member Federation. Pearson's chi-squared test of association (χ^2) compared observed counts of categorical data between genders and categories. Because of the large sample sizes, a conservative statistical significance of $P < 0.01$ was adopted.

Results

Figure 1 shows the overall participation rates of the world-ranked juniors in the 10 years after completing junior competition. Apart from Year 1, where there were no differences between genders, men were more likely than women to still be competing each year thereafter when progressing to senior competition (all $P < 0.01$). Overall, 75% of all junior men and 72% of all junior women appeared in the world rankings for senior athletes; most of those who didn't appear had competed in neither the junior nor U23 championships.

Figures 2 and 3 show the subsequent participation rates of the world-ranked juniors (men and women, respectively) in the 10 years after completing junior competition for each category identified above. Amongst the men, there were 657 who had competed in both championships (appearing in the world rankings for an average of 7.1 years), 399 in the U23 championships only (6.5 years), 788 in the junior championships only (3.3 years), and 1718 who had competed in neither championship (2.3 years). Amongst the women, there were 586 who had competed in both championships (6.7 years), 360 in the U23 championships only (6.6 years), 667 in the junior championships only (2.9 years), and 1693 who had competed in neither championship (2.0 years).

Men were more likely to be still involved in athletics in any year if they had competed in both championships or the U23s only than if they had competed in only the juniors or if they had competed in neither championship. However, those competing in the juniors only were still more likely to be competing in any year than those who had competed in neither championship. In addition, those competing in both championships were more likely to be competing in Years 1, 2, 8, 9 and 10 than those who had only competed in the U23 championships (all $P < 0.01$).

Women were also more likely to be still involved in athletics in any year if they had competed in both championships or the U23s only than if they had competed in only the juniors or if they had competed in neither championship. Similarly, those competing in the juniors only were still more likely to still be competing in any year than those who had competed in neither championship. Unlike the men, there was no difference between those women who had competed in both championships and those who had competed in the U23 championships only (all $P < 0.01$).

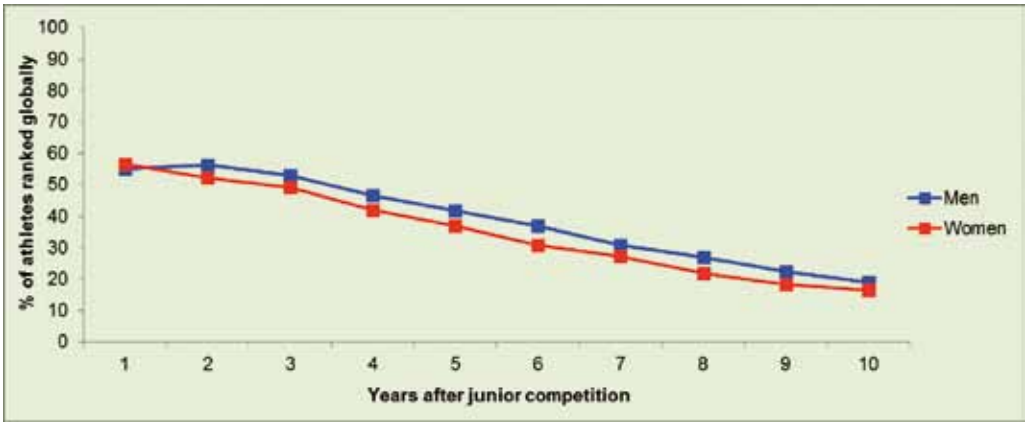

Figure 1: Percentage of all athletes to appear in the world rankings each year after junior competition

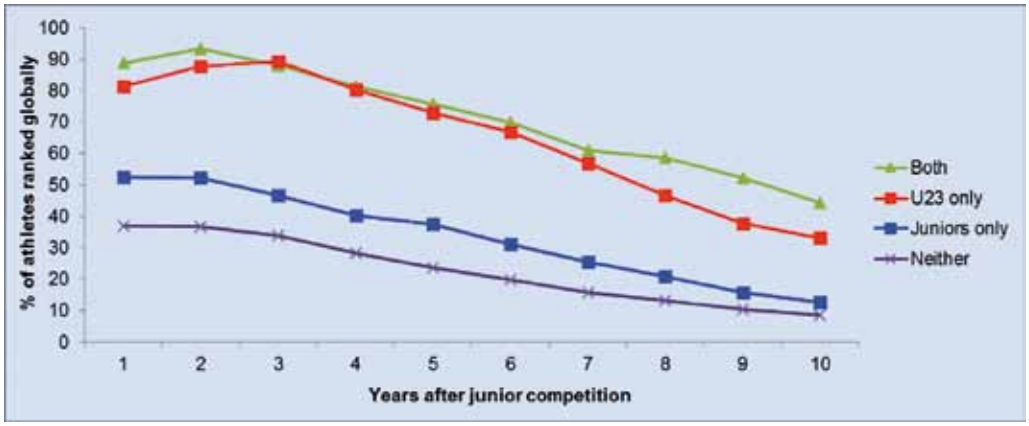

Figure 2: Percentage of male athletes to appear in the world rankings each year after junior competition

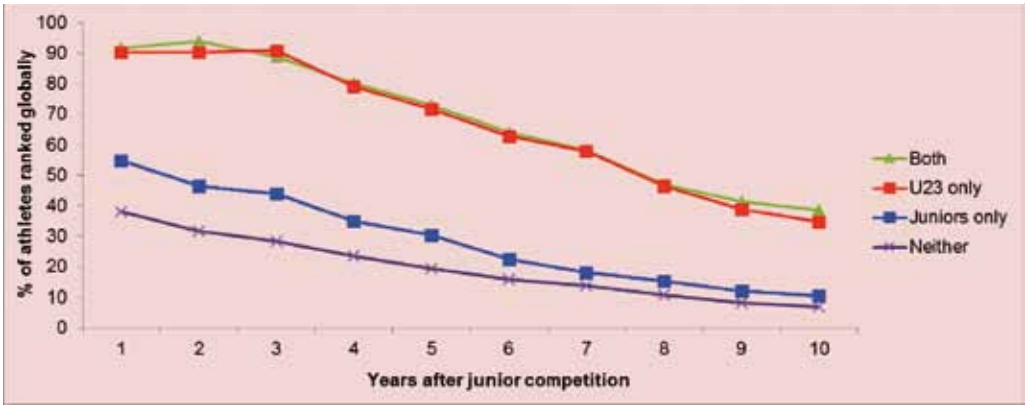

Figure 3: Percentage of female athletes to appear in the world rankings each year after junior competition

Sprints

The number of athletes competing in each of the sprint events per category is shown in Table 2. The cut-off time for junior men competing over 100m was 10.6 sec, over 200m it was 21.4 sec, and over 400m it was 48.0 sec. For the junior women's events, the cut-off times were 12.0 sec, 24.5 sec and 55.6 sec, respectively. A large number of sprinters competed in more than one event (especially the 100m / 200m double), and particularly those women who took part in the 200m as part of the heptathlon.

Table 2: Number of athletes competing in sprint events in European Athletics age-group competitions

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
100m	23	17	36	39	30	20	41	99
200m	13	4	40	40	22	11	42	54
400m	36	23	52	105	29	23	38	88

Table 3: Average number of years spent by athletes in world rankings per sprint event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
100m	6.3	6.2	3.2	2.4	5.8	6.5	2.4	2.0
200m	7.0	4.3	4.6	2.6	7.5	6.6	2.4	2.3
400m	6.6	6.0	4.1	2.2	7.0	6.0	3.8	1.4

Table 4: Average end 5-year world rankings coefficient per sprint event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
100m	0.50	0.49	0.14	0.15	0.40	0.46	0.13	0.13
200m	0.62	0.22	0.35	0.13	0.60	0.48	0.14	0.15
400m	0.46	0.45	0.22	0.13	0.52	0.46	0.25	0.07

The average number of years spent by athletes in the world rankings for the sprint events is shown in Table 3. As mentioned in the Methods, the range of possible scores was from 0 (worst) to 10 (best).

The average end 5-year coefficients for the sprint events are shown in Table 4. Higher scores are indicative of greater longevity during Years 6-10 after junior competition.

Middle Distance and Steeplechase

The number of athletes competing in each of the middle distance and steeplechase events per category is shown in Table 5 below. The cut-off time for junior men competing over 800m was 1:51, over 1500m it was 3:50.1, and for the 3000m steeplechase it was 9:10. For the junior women's events, the cut-off times were 2:10, 4:30, and 7:00 (2000m steeplechase), respectively. There was no women's steeplechase held at the 1999 European Junior or U23 Championships, and similarly junior women's rankings only began in 2001. As with the sprints, there were a large number of athletes who doubled up over 800m and 1500m.

Table 5: Number of athletes competing in middle distance / steeplechase events in European Athletics age-group competitions

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
800m	42	20	58	89	40	20	32	132
1500m	35	22	43	78	24	19	42	104
3000m SC	38	24	41	44	17	4	27	32

The average number of years spent by athletes in the world rankings for the middle distance and steeplechase events is shown in Table 6.

The average end 5-year coefficients for the middle distance and steeplechase events are shown in Table 7.

Table 6: Average number of years spent by athletes in world rankings per middle distance / steeplechase event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
800m	6.8	5.9	3.0	2.3	6.3	6.1	2.9	2.2
1500m	6.4	5.4	2.9	2.2	5.9	7.1	2.5	1.7
3000m SC	6.2	6.6	2.7	2.2	5.1	7.3	1.6	0.8

Table 7: Average end 5-year world rankings coefficient per middle distance / steeplechase event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
800m	0.50	0.40	0.16	0.10	0.43	0.43	0.09	0.14
1500m	0.48	0.38	0.15	0.13	0.42	0.60	0.16	0.09
3000m SC	0.43	0.52	0.21	0.19	0.25	0.68	0.08	0.05

Long Distance and Race Walks

The number of athletes competing in each of the long distance and race walk events per category is shown in Table 8 below. The cut-off time for junior men competing over 5000m was 14:20, over 10,000m it was 30:30, and for the 10km race walk it was 45:00. For the junior women's events, the cut-off times were 16:30, 35:00, and 50:00, respectively. There is no women's 10,000m held as part of the European Junior Championships, and thus the numbers included in the ranking list are extremely small. For the race walk, both track and road performances were included. The race walks were also noteworthy as they were the only events where no athletes doubled up with any other event.

Table 8: Number of athletes competing in long distance events in European Athletics age-group competitions

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
5000m	13	22	12	10	11	4	15	24
10,000m	14	3	22	6	-	2	-	5
Walk	39	22	52	186	28	12	24	64

The average number of years spent by athletes in the world rankings for the long distance and race walk events is shown in Table 9.

The average end 5-year coefficients for the long distance and race walking events are shown in Table 10.

Table 9: Average number of years spent by athletes in world rankings per long distance event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
5000m	6.7	6.3	3.0	1.7	7.1	3.8	1.9	1.9
10,000m	4.6	4.7	1.7	0.3	-	7.5	-	1.4
Walk	6.5	7.4	2.2	1.5	5.9	7.5	1.8	2.1

Table 10: Average end 5-year world rankings coefficient per long distance event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
5000m	0.59	0.56	0.22	0.14	0.56	0.20	0.07	0.10
10,000m	0.29	0.29	0.17	0.03	-	0.78	-	0.12
Walk	0.57	0.59	0.17	0.08	0.44	0.67	0.05	0.13

Hurdles and Combined Events

The number of athletes competing in each of the hurdles and combined events per category is shown in Table 11 below. The cut-off performance for junior men competing over 110m hurdles was 14.8 sec, over 400m hurdles it was 53.0 sec, and for the decathlon it was 6950 points. For the junior women's events, the cut-off performances were 14.2 sec (100m hurdles), 61.0 sec, and 5000 points (heptathlon), respectively.

The average number of years spent by athletes in the World Rankings for the hurdles and combined events is shown in Table 12.

The average end 5-year coefficients for the hurdles and combined events are shown in Table 13.

Table 11: Number of athletes competing in hurdles / combined events in European Athletics age-group competitions

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
100/110m	46	25	38	143	45	27	49	90
400m H	39	20	42	71	27	18	47	102
Combined	15	14	24	30	29	29	38	86

Table 12: Average number of years spent by athletes in world rankings per hurdles / combined events

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
100/110m	7.2	6.1	2.5	2.4	6.9	5.1	2.4	2.0
400m H	6.0	6.3	2.1	1.9	6.0	5.9	2.6	1.3
Combined	7.2	5.5	3.8	2.7	7.0	7.1	3.0	2.1

Table 13: Average end 5-year world rankings coefficient per hurdles / combined events

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
100/110m	0.64	0.50	0.06	0.16	0.52	0.25	0.10	0.12
400m H	0.38	0.42	0.13	0.10	0.42	0.35	0.19	0.07
Combined	0.63	0.33	0.24	0.15	0.54	0.56	0.15	0.12

Jumps

The number of athletes competing in each of the jumping events per category is shown in Table 14 below. The cut-off performance for junior men competing in the long jump was 7.30m, in the triple jump it was 15.00m, in the high jump it was 2.10m, and in the pole vault it was 5.00m. For the junior women's events, the cut-off performances were 5.95m, 12.50m, 1.74m, and 3.80m, respectively. Whereas many athletes doubled up the long jump with the triple jump, it was noticeable that very few pole vaulters took up other events.

Table 14: Number of athletes competing in jumping events in European Athletics age-group competitions

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
Long J	33	27	45	142	27	17	29	128
Triple J	23	39	52	161	35	24	41	176
High J	44	31	46	152	34	30	28	152
Pole vault	37	24	35	93	37	28	34	72

The average number of years spent by athletes in the world rankings for the jumping events is shown in Table 15.

The average end 5-year coefficients for the jumping events are shown in Table 16.

Table 15: Average number of years spent by athletes in world rankings per jumping event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
Long J	7.5	5.6	3.5	1.9	6.7	6.2	2.9	2.1
Triple J	7.2	6.6	4.3	1.9	6.8	6.9	3.9	1.8
High J	7.1	6.8	4.1	2.2	7.0	6.0	4.2	2.0
Pole vault	7.9	7.0	3.3	3.5	6.6	6.9	3.1	2.6

Table 16: Average end 5-year world rankings coefficient per jumping event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
Long J	0.61	0.41	0.22	0.12	0.51	0.49	0.11	0.11
Triple J	0.57	0.49	0.31	0.11	0.54	0.53	0.24	0.10
High J	0.57	0.55	0.28	0.12	0.53	0.38	0.30	0.12
Pole vault	0.65	0.57	0.16	0.25	0.48	0.50	0.19	0.15

Throws

The number of athletes competing in each of the jumping events per category is shown in Table 17 below. The cut-off performance for junior men competing in the shot put was 15.50m, in the discus it was 48.00m, in the hammer it was 58.00m, and in the javelin it was 65.00m. For the junior women's events, the cut-off performances were 14.00m, 48.00m, 52.00m, and 48.00m, respectively. World rankings were not available for the women's javelin in 1997 or 1998. Combining the shot putt with the discus was one of the most popular doubles amongst athletes.

Table 17: Number of athletes competing in throwing events in European Athletics age-group competitions

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
Shot	42	15	29	64	26	23	22	65
Discus	44	20	35	68	39	13	21	44
Hammer	44	18	45	71	58	26	54	111
Javelin	37	27	41	123	35	11	31	69

Table 18: Average number of years spent by athletes in world rankings per throwing event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
Shot	7.6	7.3	2.9	2.4	7.0	6.4	2.6	1.0
Discus	8.1	7.2	3.5	2.8	7.5	7.2	3.6	2.8
Hammer	8.6	7.7	4.3	3.0	7.5	7.6	3.4	2.8
Javelin	8.1	7.1	4.0	2.6	6.5	8.6	3.6	1.9

Table 19: Average end 5-year world rankings coefficient per throwing event

	Men				Women			
	Both	U23	Juniors	Neither	Both	U23	Juniors	Neither
Shot	0.63	0.62	0.20	0.18	0.50	0.50	0.15	0.04
Discus	0.75	0.56	0.26	0.23	0.61	0.52	0.23	0.18
Hammer	0.79	0.63	0.28	0.19	0.59	0.61	0.17	0.14
Javelin	0.72	0.55	0.27	0.17	0.49	0.75	0.22	0.10

The average number of years spent by athletes in the world rankings for the throwing events is shown in Table 18.

The average end 5-year coefficients for the throwing events are shown in Table 19.

The number of athletes, average number of years in athletics, and the average end 5-year coefficients for each member federation are shown in Table 20 (see next page). There were no athletes in the Junior World Rankings from Gibraltar, Liechtenstein, Monaco, Montenegro or San Marino.

Discussion

The aim of this study was to evaluate the role of the European Athletics U20 and U23 Championships in maintaining participation in athletes who were high performers as juniors. It was highly encouraging that 75% of junior men and 72% of junior women appeared in the world senior rankings at least once over the subsequent 10 years, as this in effect represents the minimum number who continued in the sport. Almost half of all athletes analysed had competed in at least one edition of either the European Junior Championships or the European U23 Championships (or both) and showed that the opportunities for high-standard age-group competition were being taken by a considerable number of young athletes. It was also evident that many athletes achieved their season's best performances at national competitions, and so there is a key role for federations and clubs in terms of keeping their athletes involved through local events also.

Athletes who took part in the European Junior Championships were more likely to stay in athletics than those who hadn't competed in either that championship or the U23 version. There is a possible psychological boost in hav-

Table 20: Progression of athletes per European Athletics Member Federation

	Men			Women		
	Number	Years	Coefficient	Number	Years	Coefficient
Albania	4	2.0	0.12	-	-	-
Andorra	2	3.5	0.00	-	-	-
Armenia	7	1.9	0.06	3	0.7	0.00
Austria	19	5.2	0.39	20	4.0	0.31
Azerbaijan	5	2.8	0.20	1	0.0	0.00
Belarus	108	4.0	0.29	102	3.9	0.25
Belgium	50	4.6	0.34	38	3.2	0.21
Bosnia-Herzegovina	4	4.5	0.30	2	0.0	0.00
Bulgaria	31	2.9	0.14	28	2.8	0.18
Croatia	31	4.3	0.28	23	4.0	0.19
Cyprus	18	5.1	0.39	7	5.3	0.43
Czech Republic	84	3.7	0.27	84	3.9	0.28
Denmark	9	4.0	0.26	7	3.7	0.19
Estonia	32	3.9	0.30	23	4.6	0.27
Finland	172	4.2	0.32	132	3.4	0.21
France	303	4.0	0.31	262	3.7	0.26
Georgia	-	-	-	2	5.0	0.20
Germany	406	3.8	0.24	502	2.8	0.18
Great Britain	254	4.0	0.29	204	4.0	0.27
Greece	124	4.2	0.32	82	3.7	0.26
Hungary	73	4.2	0.27	64	3.8	0.23
Iceland	6	4.0	0.37	5	5.2	0.32
Ireland	29	4.2	0.32	28	4.6	0.40
Israel	17	2.5	0.15	7	2.0	0.06
Italy	157	4.6	0.38	138	4.6	0.37
Latvia	34	4.3	0.30	28	3.2	0.18
Lithuania	36	3.9	0.25	28	4.8	0.36
Luxembourg	3	6.7	0.60	2	2.5	0.22
FYR Macedonia	1	0.0	0.00	1	1.0	0.00
Malta	-	-	-	1	4.0	0.80
Moldova	11	5.5	0.50	10	4.7	0.25
Netherlands	51	4.7	0.31	45	3.9	0.23
Norway	23	3.6	0.31	36	3.7	0.23
Poland	275	3.2	0.19	234	2.8	0.15
Portugal	50	3.3	0.23	33	5.5	0.50
Romania	67	2.6	0.19	109	2.6	0.14
Russia	470	3.5	0.23	529	3.3	0.20
Serbia	23	2.5	0.26	22	1.9	0.19
Slovakia	35	4.5	0.40	27	3.7	0.32
Slovenia	31	3.1	0.21	29	4.0	0.32
Spain	176	3.9	0.29	66	5.5	0.46
Sweden	89	4.4	0.30	88	3.8	0.28
Switzerland	25	3.7	0.25	37	3.1	0.19
Turkey	15	5.3	0.40	35	3.9	0.28
Ukraine	202	4.1	0.28	182	3.4	0.20
Total	3562	3.9	0.27	3306	3.5	0.23

ing competed in a major championship that motivates athletes to continue in the sport, and Member Federations should be encouraged to send juniors to these championships provided they have the qualifying standard. However, it should be acknowledged that opportunities for athletes to compete in the European Junior Championship are limited to those who are selected ahead of their national rivals. This particularly affects those athletes from stronger nations where athletics is especially popular (e.g. between them, Germany and Russia alone accounted for 25% of all junior men and 31% of all junior women analysed in this study), and means those federations have to take special care to encourage and acknowledge all their junior athletes regardless of ability.

One of the indisputable results from this study was that those athletes who took part in the U23 championships had the longest senior careers, and across all track and field events. Athletes who took part in both the Junior and U23 championships fared essentially the same as those who took part in the U23 championships only, showing that it was the latter event that was the key factor in increasing athletes' future participation. Overall, both men and women who competed in the U23 championships had senior careers lasting between three to four years longer than those who didn't, with more than 50% of those who took part appearing in the world senior rankings up to seven years after finishing junior competition.

The comparisons between end 5-year coefficients provided additional unequivocal evidence that athletes in their late 20s were more likely to still be competing if they had taken part in the U23 championships. There is therefore an obvious rationale for Member Federations to send athletes to the biennial U23 championships. Given their proximity in the athletics calendar to the IAAF World Championships, they offer an excellent opportunity for federations to send those young athletes who haven't qualified for that global competition to a championship that has been clearly shown to increase the length of participation.

The best events with regard to maintaining participation during the senior years were those in which European athletes are traditionally strong, such as the 400m, jumps, throws, and combined events. By contrast, the weakest events were those traditionally dominated by other areas, such as middle and long distance running (by Africa), and very few European athletes even appeared in the world junior rankings in the first place. For men, the most successful event was the hammer, with an average of 8.6 years spent in the world senior rankings by the 44 men who had competed in both the Junior and U23 championships (the discus and javelin were the next best events). In addition, these events had the highest end 5-year coefficients of all events. The hammer and discus were also particularly strong in this regard for the women and the career paths of throwers might therefore be worth exploring in terms of what factors lead to their better longevity in the sport (e.g. the opportunities for competing in events like the European Throwing Cup, which incorporates an U23 competition).

Traditionally strong Member Federations in European Athletics (e.g. Great Britain, France and Ukraine) had the greatest number of athletes appearing in the ranking lists of top junior athletes. However, as mentioned above, the challenge for more populous federations is to ensure that their large number of athletes is catered for as well as possible with regard to competition opportunities. This was reflected in conversion rates to world rankings that were worse than average for European athletics powerhouses like Russia, Germany and Poland. Equally, smaller Member Federations struggled to have many if any athletes progress to senior competition (the end 5-year coefficients for several nations were zero). As there are limitations on who can be selected for major championships like the European or world juniors, other international events can be provided for young athletes such as regional competitions (e.g. in Scandinavia / the Balkans) that incorporate junior and U23 competition. Several nations with fewer numbers but strong athletics traditions (e.g. Greece, Spain

and Italy) had better conversion rates, and it might be worth looking more in depth at their junior-to-senior development programmes to see what elements work particularly well.

Men were more likely than women to still be competing two years after junior competition and onwards (an average of 4% more per year). One factor that could account for women's lower participation rates is motherhood and the time taken out during pregnancy in particular. Many women successfully return to competition after having a child (e.g. Jessica Ennis-Hill (GBR) won the World Championship heptathlon title in 2015 having given birth in July 2014) but this is not always feasible. Nonetheless, the participation rates for men and women did not differ considerably and thus coaches and administrators should ensure equitable opportunities when encouraging both male and female junior athletes to continue competing in the sport. These include monitoring for risk of injury and psychological burnout, both of which can occur if junior athletes are training and competing too much.

This study has shown that the European Athletics U20 and U23 Championships play an important role in maintaining participation in young athletes as they move through the senior ranks. There are many reasons why athletes drop out of the sport, and these are not unique to athletics but affect young people in all sports. For example, the transition from a largely school-based environment to one of full-time employment or higher education (many young people move to universities far from the familiar support structures of their homes and club) can be challenging because of the nature of the demands involved. The transition from junior to senior competition is not only a transfer to a higher standard of competition, and perhaps increased competitive challenges (e.g. higher hurdles, longer distances), but more pertinently a change to a whole new way of life. If at all possible, clubs and federations should implement programmes that ease this transition from junior competition onwards (which already includes the EAA's U23 competition programme). This could include other supportive competition structures, athlete development programmes, and for many athletes close cooperation between federations and universities can be especially crucial.

Conclusion

This study has shown that the European Athletics U20 and U23 Championships improve participation rates as junior athletes move into the senior rankings. The U23 championships were particularly effective in maintaining participation between the ages of 25 and 29. Men and women did not differ greatly, although certain events had longer participation rates (especially the throws). Additionally, maintaining junior athletes' involvement in the sport might be more difficult in very large and small nations where even being good enough to be selected for age group championships is a considerable challenge. Although the focus of this study was on athletes who had appeared in the world junior rankings, this was predominantly because of the ease with which these athletes could be tracked over the course of the subsequent 10 years; supporting junior athletes of all abilities is important from the point of view of remaining competitive for life and, by extension, fit for life.

Recommendations

The European Athletics U20 and U23 Championships are invaluable for the development of senior athletes and help to maintain participation in the sport. Member Federations should enter as many athletes as possible (e.g. with respect to qualifying standards / limits on numbers). At the same time, coaches and administrators should encourage all junior and U23 athletes, regardless of whether they are good enough to be selected. Many senior athletes won't yet have reached the standard required but can prosper later given appropriate support and guidance.

Member Federations should implement programmes that ease the many aspects in-

volved in the transition from junior competition onwards. This could involve managing closer ties with schools, universities and work-based athletics structures (such as the the Business Houses Athletic Association (BHAA) in Ireland[7]), especially as many participants might not be members of athletics clubs.

Because so few athletes can compete at large international competitions such as the European Athletics U20 and U23 Championships, it is important for Member Federations to be creative with competition, for example by co-operating with other federations (similar in size / location) to organise suitable age-group and senior competition. Currently successful examples include the annual Finnkampen match between Finland and Sweden, the relatively new Mediterranean U23 Championships and the biennial Championships of the Small States of Europe. Strong national competitions are also crucial to maintaining the rivalries and friendships that motivate athletes to compete against one another and stay active in the sport.

Athlete development programmes that assist young athletes to move up to senior competitions should be encouraged in each federation. These could include medical and scientific services, training support, and psychological monitoring to ensure that young athletes who are still developing are not overworked, and so avoid attrition resulting because of early career injury or burnout.

As suggested in previous research[2], other events might lend themselves to U23 competitions or sub-events; for example, the European Race Walking Cup event could feasibly include an U23 category and this could be invaluable for this event given the step-up in distance from junior (10km) to senior competition (20km).

Future studies could examine the value of smaller events like the U23 competitions held as part of the European Cross Country Championships and European Throwing Cup in terms of encouraging participation in senior competition. Similar studies at IAAF level could also be conducted, as well as research on events held predominantly for young people such as the Universiade (World University Games).

This study has identified several federations that are particularly successful at maintaining participation in athletes, as well as the more successful events; studies that examine more closely the factors involved could be beneficial in learning how best to maintain participation for life.

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